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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
MALEK, LEILA	

ART UNIT	PAPER NUMBER
2611	

MAIL DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)
	10/534,806	BIRRU, DAGNACHEW
	Examiner	**Art Unit**
	LEILA MALEK	2611

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 May 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-23* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-10,14,15,19 and 21-23* is/are rejected.

7)☒ Claim(s) *11-13,16-18 and 20* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *12 May 2005* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *05/12/2005*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Priority

1. Applicant's claim for the benefit of a prior-filed application under 35 U.S.C. 119(e) or under 35 U.S.C. 120, 121, or 365(c) is acknowledged.

Information Disclosure Statement

2. The information disclosure statement submitted on 05/12/2005 has been considered and made of record by the examiner.

Drawings

3. Figure 1 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1-3, 6, 7, 9, 10, 14, 15, 19, and 21-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Turner (US 5,561,687), in view of Fertner (US 5,793,801).

As to claim 1, Turner discloses a method for performing equalization on an input signal, comprising: creating a plurality of delayed samples of the input signal (see e.g., block 12, in Fig. 1 and column 1, lines 43-51); weighting the plurality of delayed input samples using a first corresponding plurality of adaptive coefficients (see coefficients 13, and column 2, lines 3-7); and summing (see summers 14 and 16) the weighted plurality of delayed input samples along with a feedback signal (see the output of summer 24) and outputting a result of the summing as an equalizer output signal. Turner discloses all the subject matters claimed in claim 1, except for orthogonally transforming each of the plurality of delayed input samples, and weighting the plurality of orthogonally-transformed delayed input samples using a plurality of transformed adaptive coefficients. Fertner, in the same field of endeavor, discloses a digital communication system (see the abstract), comprising a filter structure (see Fig. 4). Fertner, shows creating a plurality of delayed samples of the input signal (see blocks 80a-80N); orthogonally transforming (see column 8, lines 40-41) each of the plurality of delayed input samples (see DFT block 82); weighting the plurality of orthogonally-transformed delayed input samples using a plurality of transformed adaptive coefficients (see units 84a-84N); and summing (see summer 86) the weighted plurality of delayed input samples. It would have been obvious to one of ordinary skill in the art at the time of invention to modify Turner as suggested by Fertner to accurately reconstruct the

received signal rather than just approximating it in the time domain (see Fertner column 3).

As to claim 2, Turner discloses that the feedback signal is formed by: creating a plurality of delayed samples of a receiver decision signal (see block 21); weighting the plurality of delayed decision samples using a second corresponding plurality of adaptive coefficients (see coefficients 23); and summing the weighted plurality of delayed decision samples to create the feedback signal (see adder 24). Fertner, in the same field of endeavor, discloses a digital communication system (see the abstract), comprising a filter structure (see Fig. 4). Fertner, as explained in rejection of claim 1, shows creating a plurality of delayed samples of the input signal (see blocks 80a-80N); orthogonally transforming (see column 8, lines 40-41) each of the plurality of delayed input samples (see DFT block 82); weighting the plurality of orthogonally-transformed delayed input samples using a plurality of transformed adaptive coefficients (see units 84a-84N); and summing (see summer 86) the weighted plurality of delayed input samples. It would have been obvious to one of ordinary skill in the art at the time of invention to modify Turner as suggested by Fertner to accurately reconstruct the received signal rather than just approximating it in the time domain (see Fertner column 3).

As to claim 3, Turner shows that the feedback signal is formed by: creating a plurality of delayed samples of a receiver decision signal (see block 21);
weighting the plurality of delayed decision samples using a plurality of adaptive

coefficients (see coefficients 23 and column 2, lines 3-7); and summing (see summer 24) the weighted plurality of delayed decision samples to create the feedback signal.

As to claim 6, Turner further shows coupling the equalizer output signal to a decision device 18 and receiving a receiver decision signal back from the decision device (see the output of slicer 18).

As to claim 7, Turner discloses updating the plurality of adaptive coefficients (see column 2, lines 3-7).

As to claim 9, Turner discloses updating the second corresponding plurality of adaptive coefficients (see column 2, lines 3-7).

As to claim 14, Turner discloses updating the first corresponding plurality of adaptive coefficients (see column 2, lines 3-7).

As to claims 10 and 15, Fertner discloses that the step of updating the plurality of transformed adaptive coefficients includes the calculations as cited by the Applicant in claims 10 and 15 (see column 8).

As to claim 19, Fertner does not expressly disclose that orthogonally transforming comprises computing a transform of each of the plurality of delayed input samples in a recursive manner by using a prior orthogonal transform of a prior one of the plurality of delayed input samples in a next orthogonal transform of a next one of the plurality of delayed input samples. However, it would have been obvious to one of ordinary skill in the art at the time of invention to modify the DFT used by Fertner in order to take advantage of a recursive structure to minimize computation and maximize the speed of calculations in the system.

As to claim 21, Turner discloses a method for performing equalization on an input signal, comprising: creating a plurality of delayed samples of the input signal (see e.g., block 12, in Fig. 1 and column 1, lines 43-51); weighting the plurality of delayed input samples using a first corresponding plurality of adaptive coefficients (see coefficients 13, and column 2, lines 3-7); and summing (see summers 14 and 16) the weighted plurality of delayed input samples along with a feedback signal (see the output of summer 24); outputting a result of the summing as an equalizer output signal, and modifying the first corresponding plurality of adaptive coefficients based on decisions made in the receiver using prior versions of an equalizer output signal (see column 2, lines 3-7). Turner discloses all the subject matters claimed in claim 21, except for orthogonally transforming each of the plurality of delayed input samples, and weighting the plurality of orthogonally-transformed delayed input samples using a plurality of transformed adaptive coefficients. Fertner, in the same field of endeavor, discloses a digital communication system (see the abstract), comprising a filter structure (see Fig. 4). Fertner, shows creating a plurality of delayed samples of the input signal (see blocks 80a-80N); orthogonally transforming (see column 8, lines 40-41) each of the plurality of delayed input samples (see DFT block 82); weighting the plurality of orthogonally-transformed delayed input samples using a plurality of transformed adaptive coefficients (see units 84a-84N); and summing (see summer 86) the weighted plurality of delayed input samples. It would have been obvious to one of ordinary skill in the art at the time of invention to modify Turner as suggested by Fertner to accurately reconstruct the

received signal rather than just approximating it in the time domain (see Fertner column 3).

As to claim 22, Turner discloses a method for performing equalization on a digital signal (see column 1, line 14), comprising: creating a plurality of delayed samples of the input signal (see e.g., block 12, in Fig. 1 and column 1, lines 43-51); weighting the plurality of delayed input samples using a first corresponding plurality of adaptive coefficients (see coefficients 13, and column 2, lines 3-7); and summing (see summers 14 and 16) the weighted plurality of delayed input samples along with a feedback signal (see the output of summer 24); outputting a result of the summing as an equalizer output signal, and modifying the first corresponding plurality of adaptive coefficients based on decisions made in the receiver using prior versions of an equalizer output signal (see column 2, lines 3-7). Turner discloses all the subject matters claimed in claim 22, except for orthogonally transforming each of the plurality of delayed input samples, and weighting the plurality of orthogonally-transformed delayed input samples using a plurality of transformed adaptive coefficients. Fertner, in the same field of endeavor, discloses a digital communication system (see the abstract), comprising a filter structure (see Fig. 4). Fertner, shows creating a plurality of delayed samples of the input signal (see blocks 80a-80N); orthogonally transforming (see column 8, lines 40-41) each of the plurality of delayed input samples (see DFT block 82); weighting the plurality of orthogonally-transformed delayed input samples using a plurality of transformed adaptive coefficients (see units 84a-84N); and summing (see summer 86) the weighted plurality of delayed input samples. It would have been obvious to one of

ordinary skill in the art at the time of invention to modify Turner as suggested by Fertner to accurately reconstruct the received signal rather than just approximating it in the time domain (see Fertner, column 3).

As to claim 23, Turner discloses an apparatus for receiving a digital signal (see column 1, line 14), comprising: a receiver decision device 18; and an adaptive equalizer coupled to the receiver decision device 11, the equalizer including a processor to: create a plurality of delayed versions of the digital signal (see delay blocks 12); weight the delayed versions of the digital signal using a plurality of transformed adaptive coefficients (see weighting coefficients 13); sum (see summers 14 and 16) the weighted plurality of delayed versions of the digital signal along with a feedback signal to create an equalized output signal; and adaptively update the plurality of adaptive coefficients based on decisions made in the receiver decision device using prior versions of an equalized output signal (see column 2, lines 3-7). Turner discloses all the subject matters claimed in claim 23, except for orthogonally transforming each of the plurality of delayed input samples, and weighting the plurality of orthogonally-transformed delayed input samples using a plurality of transformed adaptive coefficients. Fertner, in the same field of endeavor, discloses a digital communication system (see the abstract), comprising a filter structure (see Fig. 4). Fertner, shows creating a plurality of delayed samples of the input signal (see blocks 80a-80N); orthogonally transforming (see column 8, lines 40-41) each of the plurality of delayed input samples (see DFT block 82); weighting the plurality of orthogonally-transformed delayed input samples using a plurality of transformed adaptive coefficients (see units 84a-84N); and summing (see

summer 86) the weighted plurality of delayed input samples. It would have been obvious to one of ordinary skill in the art at the time of invention to modify Turner as suggested by Fertner to accurately reconstruct the received signal rather than just approximating it in the time domain (see Fertner, column 3).

5. Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Turner and Fertner, further in view of Suzuki et al. (hereafter, referred as Suzuki) (US 5,481,553).

As to claim 4, Fertner does not expressly disclose that the orthogonal transformation is a Fast Fourier transformation. Suzuki discloses that Fast Fourier Transformation is a well-known type of orthogonal transformation (see column 1, second paragraph). It would have been obvious to one of ordinary skill in the art at the time of invention to modify Fertner as suggested by Suzuki to alternatively use other known techniques instead of the one taught by Fertner to speed up the calculations related to the transformation process.

As to claim 5, Fertner does not expressly disclose that the orthogonal transformation is a Discrete Cosine transformation. Suzuki discloses that Discrete Cosine Transformation is a well-known type of orthogonal transformation (see column 1, second paragraph). It would have been obvious to one of ordinary skill in the art at the time of invention to modify Fertner as suggested by Suzuki to alternatively use other known techniques instead of the one taught by Fertner to speed up the calculations related to the transformation process.

6. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Turner and Fertner, further in view of Hwang et al. (hereafter, referred as Hwang) (US 2002/0027953).

As to claim 8, Fertner disclose that adaptive least-mean square algorithm has been used to update the filter coefficients (see column 8, lines 18-42). However, Fertner is silent in disclosing the formula cited in claim 8. Hwang, in the same field of endeavor, discloses a filter structure which uses LMS adaptive filtering approach. Hwang discloses formula: $C_k(n+1)=c_k(n)+ser(n)x^*(n-k)$, for updating the plurality of adaptive coefficients (see paragraph 0026-0031); wherein er(n)=d(n)-z(n); where, s is the adaptation step size, er(n) is the error, d(n) is the receiver decision signal (see paragraph 0026), and z(n) is the equalizer output. It would have been obvious to one of ordinary skill in the art at the time of invention to modify Turner and Fertner as suggested by Hwang to implement the LMS adaptive filtering technique.

Allowable Subject Matter

7. Claims 11-13, 16-18, and 20 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to LEILA MALEK whose telephone number is (571)272-8731. The examiner can normally be reached on 9AM-5:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mohammad Ghayour can be reached on 571-272-3021. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Leila Malek
Examiner
Art Unit 2611

/L. M./
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